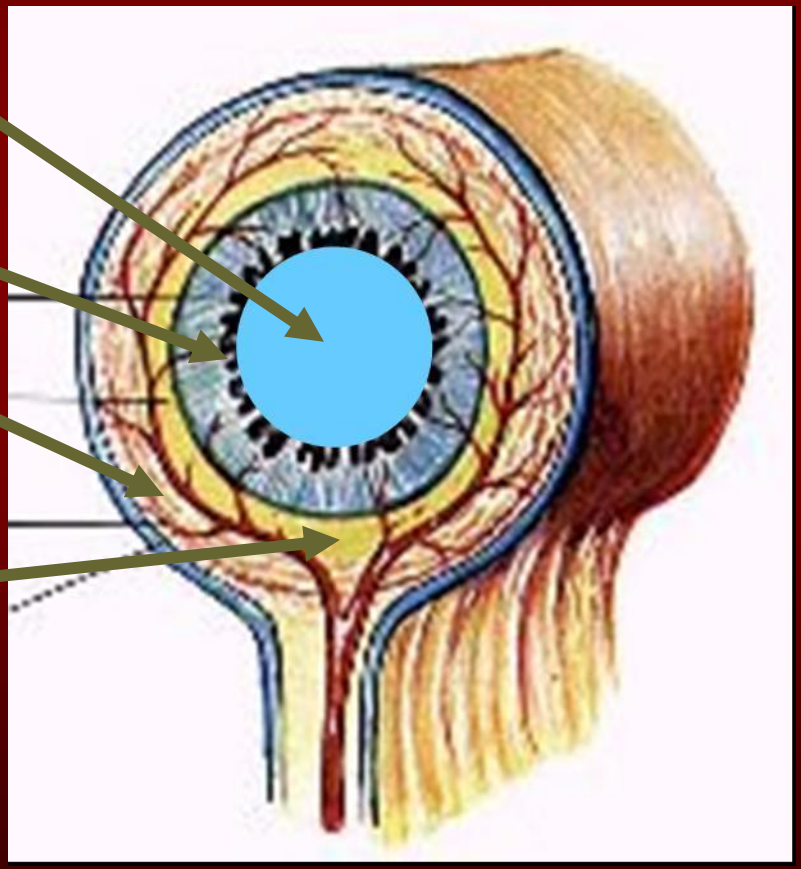
Integration of Tissues

Small intestine as an example.

- **Cavity (lumen) with food.**
- **Epithelium for lining secretion and absorption.**
- **Muscle for moving food.**
- **Connective tissue to join.**
- **Nerves (not seen).**



3.Connective Tissue

- **Connective tissue differs from other tissues in that it contains large amounts of extracellular matrix.**
- **It is found everywhere and includes the most abundant and widely distributed tissue**

Functions of Connective Tissues

- **Bind tissues together**
- **provide support**
- **provide nourishment**
- **store wastes**
- **repair damaged tissues (mesenchymal cells)**

- **These tissues are generally well vascularized**
  - **Exceptions: tendons, ligaments**

True Connective Tissue Cells

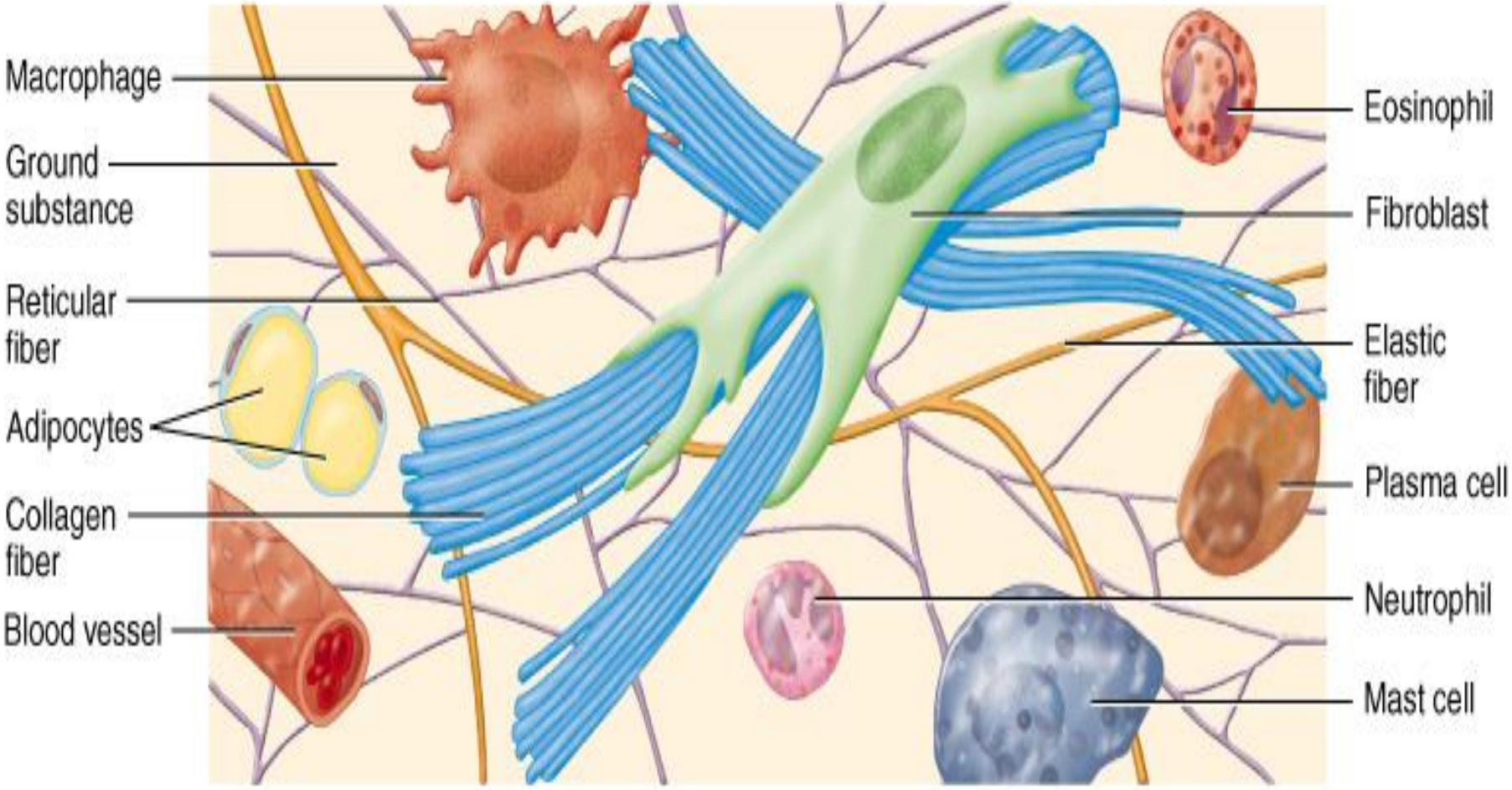
Fibroblasts: Secrete both fibers and ground substance of the matrix

Macrophages: Phagocytes that develop from Monocytes

Plasma Cells: Antibody secreting cells that develop from B Lymphocytes

Mast Cells: Produce heparin (blood clotting), histamine that help dilate small blood vessels in reaction to injury

Adipocytes: Fat cells that store triglycerides, support, protect and insulate


Macrophage
Ground substance
Reticular fiber
Adipocytes
Collagen fiber
Blood vessel
Eosinophil
Fibroblast
Elastic fiber
Plasma cell
Neutrophil
Mast cell

Matrix Fibers

Collagen Fibers: Large fibers made of the protein collagen and are typically the most abundant fibers. Promote tissue flexibility.

Elastic Fibers: Intermediate fibers made of the protein elastin. Allow stretch and recoiling

Reticular Fibers: Small delicate, branched fibers that have same chemical composition of collagen. Forms structural framework for organs such as spleen and lymph nodes.

Matrix Ground Substance

Hyaluronic Acid:

Complex combination of polysaccharides and proteins found in "true" or proper connective tissue.

Chondroitin sulfate:

Jellylike ground substance of cartilage, bone, skin and blood vessels.

Other ground Substances:

Dermatin sulfate, keratin sulfate

TYPES OF CONNECTIVE TISSUE

1. Proper (True) Connective Tissue

a. Loose Connective Tissue

b. Dense Connective Tissue

2. Supportive Connective Tissue

a. Cartilage

b. Bone

3. Vascular (Liquid) Connective Tissue

a. Blood

Proper Connective Tissue

1. Loose connective tissue

a. Areolar tissue

Widely distributed under epithelia

b. Adipose tissue

Hypodermis, within abdomen, breasts

c. Reticular tissue

Spleen, Lymphoid organs such as lymph nodes

d. Mucous tissue

Umbilical cord, artery and veins

Proper Connective Tissue

2. **Dense Connective Tissue:**

   a. **Dense regular connective tissue**

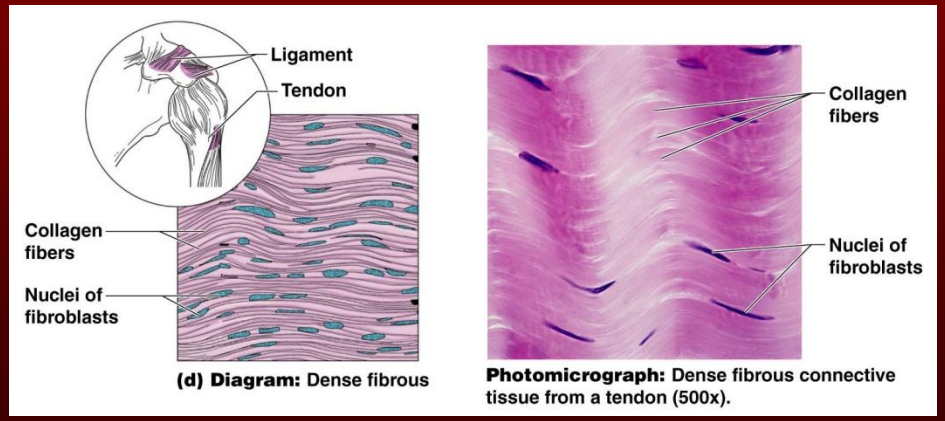
      Ex: Tendons and ligaments

   b. **Dense irregular connective tissue**

      Ex: Dermis of skin, submucosa of digestive tract

Dense Connective Tissue

- Dense connective tissue contains a large number of fibers with only a few cells.
- Fibers shown here are all running parallel to each other, and no cells are present.
- **Tendons** (connect muscle to bone)
- **ligaments** (connect bone to bone)



Supportive Connective Tissue

1.CARTILAGE:

- Jelly-like matrix (chondroitin sulfate) containing collagen, elastic fibers and chondrocytes.

- Unlike other CT, cartilage has NO blood vessels or nerves except in the perichondrium (the outermost sheath of chondrocytes).

Supportive Connective Tissue

Types of cartilages:

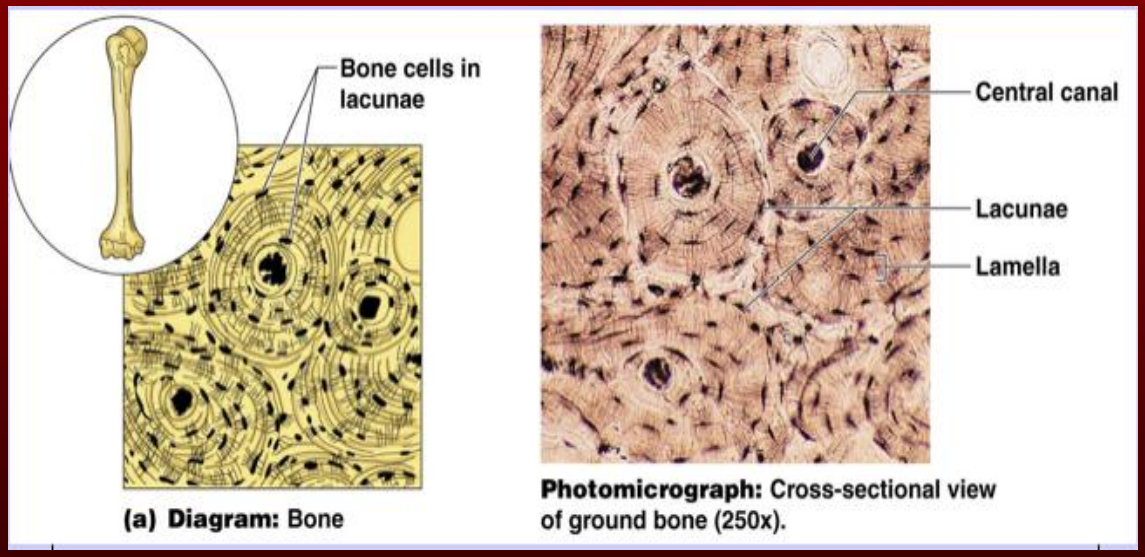
1. **Hyaline cartilage (Ex: Trachea)**
2. **Fibrocartilage (Ex: inter-vertebral discs)**
3. **Elastic cartilage (Ex: External ear)**

Supportive Connective Tissue

2. Bone

Composed of

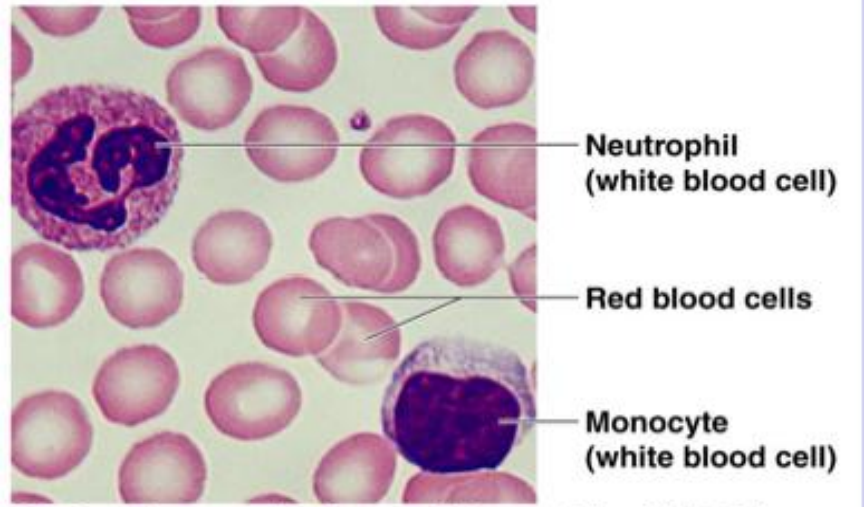
- **Bone cells in lacunae**
- **Hard matrix of calcium salts (dense bone)**



Vascular Connective Tissue

Blood

- Consists of blood cells surrounded by nonliving fluid matrix called blood plasma
- ‘Fibers’ only visible during blood clotting
- Functions as a transport medium for nutrients and gases



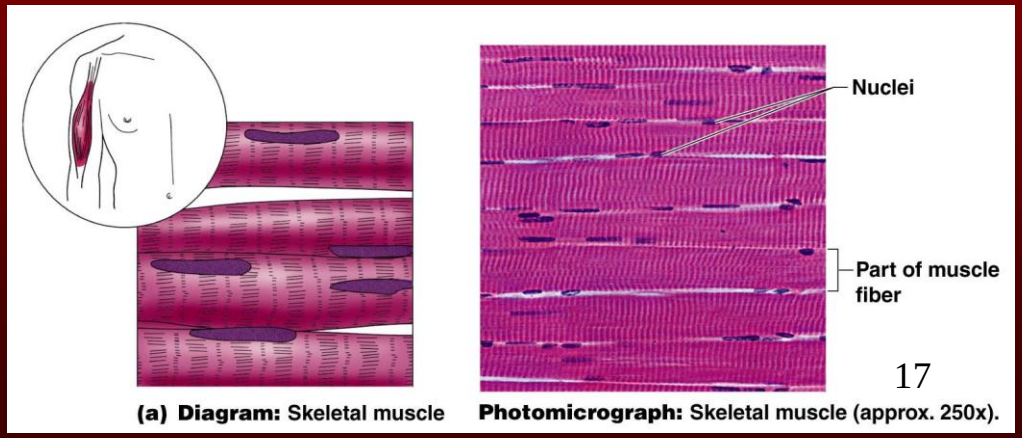
Photomicrograph: Smear of human blood (1300x)

4. Muscle Tissue

- Muscle is a contractile tissue.
- There are three types of muscle:
  - Skeletal
  - Cardiac
  - Smooth

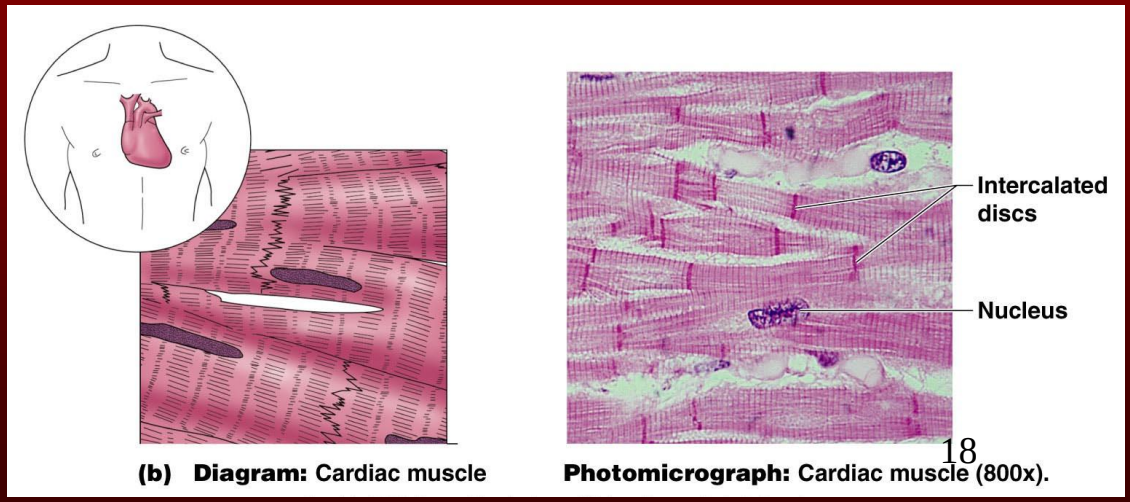
A.Skeletal Muscle

- Under **voluntary** control
- Contracts to pull on bones or skin
- Produces gross body movements or facial expressions
- Characteristics of skeletal muscle cells
  - Striated (stripe-like pattern)
  - Multinucleate (more than one nucleus)
  - Long, cylindrical



B.Cardiac Muscle

- Under **involuntary** control
- Found only in the heart
- Characteristics of cardiac muscle cells
  - Cells are attached to other cardiac muscle cells at **intercalated disks**
  - Striated
  - One nucleus/cell



(b) **Diagram:** Cardiac muscle

Photomicrograph: Cardiac muscle (800x).

C.Smooth Muscle

- Under **involuntary** control
- Found in walls of hollow organs such as stomach, uterus, and blood vessels
- Characteristics of smooth muscle cells
  - No visible striations
  - One nucleus/cell
  - Spindle-shaped cells